A RESEARCH DESIGN FOR THE STUDY OF HUMAN SETTLEMENT AND ENVIRONMENTAL CHANGE IN SOUTHWESTERN O'AHU: RE-EVALUATION OF THE STRATEGY BASED ON NEW WORK

Bertell D. Davis
Department of Anthropology
University of Hawaii at Manoa
Honolulu, Hawaii 96822

An essential function of the research design is to model what is currently known of a given subject in order to determine new directions for further research. It is thus an analytical device which requires periodic revision as new data become available.

Using initial archaeological survey and test excavation data collected from Barbers Point, O'ahu (Fig. 1), I suggested a tentative model for investigating the nature of human settlement and environmental change in presumably marginal leeward regions of the high Hawaiian Islands (Davis & Griffin 1978; Davis 1980a). Archaeological surveys have since been extended into areas immediately adjacent to the original survey (Sinoto 1979), including West Beach on the north (Barrera 1979), and into areas of Ewa Beach to the east (Davis 1980b). Excavation of selected aboriginal habitation sites has also been recently undertaken (Davis ms.). Although the results are still quite preliminary, the new data provide some confirmation of the overall model as originally proposed. But these same data also raise certain questions regarding a number of methodological assumptions underlying that model.

It is, therefore, necessary not only to evaluate the research design at the site/area-specific level (i.e., Barbers Point/coastal southwestern O'ahu), but also to give more explicit consideration to broader implications for prehistoric Hawaiian settlement in general than has thus far been the case.

There are two such broad areas of theoretical interest* which bear directly upon developing and further refining the research design. First is the nature of marginal environments in terms of human settlement and subsistence. The second concerns the utility of the ahupua'a concept as a basis for understanding aboriginal socio-economic organization.

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* A more complete discussion of the natural environmental setting of coastal southwestern O'ahu, and a preliminary synthesis and re-evaluation of the current research design based on new work is in preparation (Davis ms.).

To begin with, it is generally assumed that southwestern O'ahu and other similarly semi-arid leeward regions in Hawai'i were environmentally too marginal to have supported significant resident populations during pre-European-contact times. Marginality is used here as a relative measure of constraint the habitat imposes upon its human population. The term itself implies an element of risk stemming from disparities and uncertainties inherent in the local and/or regional setting. Appropriate demographic and productive strategies would be required to (a) minimize risk over the long term, or (b) optimize or maximize seasonal or localized resources (production) for shorter-term gain (Gould 1975, 1977). This perspective explicitly ties residence in the region to the availability and/or predictability of essential resources and to the mode of exploitation. Thus, although seasonal or localized abundance of resources might have enhanced the prospects for an optimizing or maximizing strategy, it is likely that such a strategy would have allowed for only temporary occupancy in the region. Conversely, permanent residence would most probably have been viable only within a risk-minimizing framework.

The distinction is important when it is questioned why such marginal regions should ever have been settled in the first place, particularly in view of the high productivity generally assumed for those regions under intensive irrigated taro cultivation. Indeed, although perhaps largely a problem of sampling, there is nevertheless little evidence for settled occupation of these regions prior to 1200 AD. Yet within the next two centuries there is an apparently phenomenal expansion of settlement into nearly all leeward areas of the Hawaiian Islands. This suggests a very fundamental reorientation of settlement possibly in response to population-resource imbalances stemming from actual growth of earlier settlements, or from increasing differential access to resources and decision making, or perhaps from other factors yet to be determined (Cordell & Plog 1979: 411-412).

The data are still quite limited but the number of cultural features, the size of individual habitation structures, and the extent of the sited areas indicate that the whole coastal portion of southwestern O'ahu once supported a large and possibly permanently resident prehistoric population. This settlement apparently utilized a potentially diverse, if somewhat rigorous, environment. The offshore and inshore marine zones were exploited for fish and shellfish. Crustaceans, shellfish, and possibly edible seaweeds were gathered along the shoreline. Inland marshes recently identified at Ewa Beach and (previously in the Barbers Point area (Davis 1980b) may have provided additional fish, shellfish, and crustaceans, and possibly birds. Some food plants may also have been cultivated along the margins of the marshes, as well as in the modified sinkholes and sediment-filled depressions as suggested by previous analyses

(Sinoto 1976; Davis & Griffin 1978). Finally, the natural grasslands and/or lowland forests were likely exploited for building materials, firewood, and again, possibly for birds.

What is not known, however, is the relative importance of the different resource zones in the overall subsistence of the settlement. This is necessary information for estimating the net productivity, or carrying capacity, of the local resource base and its relationship to the size of the former population--and, ultimately, for determining whether the coastal settlement was self-supporting or not.

Carrying capacity is an analytically useful concept but it is not without inherent difficulties. Its approach is thermodynamic (Shawcross 1972), and correctly presumes a systematic correlation between the size of a human population and its sustaining environment in terms of (a) the exchange of energy in production and consumption, (b) the strategies and technology of subsistence production, and (c) the requirements of human nutrition under given conditions. Archaeologically, the difficulties arise in defining and quantifying meaningful analytical units, and then in comparing the resulting data with that presently available on resource yields and nutritional needs. The former is partly due to differential preservation, especially of possible horticultural remains. But it also results from not knowing just how much of a given resource system was utilized at one time, or how much of a given product was actually consumed. For instance, rarely is all potentially arable land ever under simultaneous cultivation in traditional agricultural systems. Furthermore, in Hawai'i as elsewhere in the Pacific, much of the agricultural production was apparently used for feeding pigs (and dogs to a lesser extent) which, while a source of protein in the aboriginal diet, competed with man for agricultural products. (This is in part the significance of finding possible pig or dog remains in the hearth of a cook house at Barbers Point). As regards the latter of the difficulties in using carrying capacity: firstly, yield data are frequently inconsistent or not available for many of the traditional resources, and secondly because the presently available data on nutritional requirements are all from modern populations often quite removed from their traditional economies. As a result, these comparative data are highly variable.

Nevertheless, use of the carrying capacity model in the quantitative analysis of archaeological middens (Cook 1946; Ascher 1959; Shawcross 1967, 1970), in areal analysis of former agricultural systems (Bellwood 1972), and in the spatial analysis of surrounding habitats (Jarman et al. 1972; Foley 1977) has produced interesting results in estimating prehistoric populations.

Another, seemingly more direct, approach to estimating the size of former populations is to use residential floor areas (Naroll 1962; LeBlanc 1971; Wiessner 1974; and others). However, this approach is based implicitly on the concept of personal or

social space (Sommer 1969), a most variable commodity within even the same cultural system, and one which leaves the archaeologist with little better control than using modern data on resource yields and nutritional requirements. And again, as with estimating carrying capacity, there is the problem of contemporaneity, since it is most unlikely that all the former residences had been occupied at the same time.

One solution to this dilemma may be to combine structural evidence with a modified carrying capacity model such as that used by Bellwood (1972: 40-44) in his analysis of the Hanatekua Valley sites in the Marquesas Islands. Bellwood himself acknowledges the many unknowns in this analysis, such as the lack of information on fishing and shellfish gathering in the overall economy of the valley (the study was based on surface survey data only), but the results of comparing the two methods suggest that a similar approach to the southwestern O'ahu sites might be useful.

In one respect, Bellwood was at an advantage in Hanatekua Valley since it presented a physiographically defined area which facilitated estimating the probable carrying capacity of at least the terrestrial resource zone. This unfortunately is not the case in southwestern O'ahu. For instance, there are the accessible uplands and, potential social-political boundaries aside, the adjacent coastlines. If the coastal settlement in southwestern O'ahu was indeed not self-supporting, then it would be from these areas that the supplemental resources would have been obtained. Intuitively, it seems that shortage of carbohydrates from cultivated plants would potentially have been the most serious deficiency. This would have required that either the necessary supplement be brought down (from the upland agricultural zone?) to the coast, or the coastal population periodically move to the uplands or adjacent areas. It is, therefore, an issue of fundamental importance to understanding the nature of prehistoric Hawaiian settlement in not only southwestern O'ahu but in other presumed marginal regions of the Hawaiian Islands as well, and further for understanding the nature of marginality itself as an analytical concept.

Because the southwestern O'ahu study area now comprises the entire seaward portion of the largest ahupua'a (Honouliuli) on the island, the research design must also examine more fully the utility of the ahupua'a concept for investigating aboriginal social and economic organization in the region. At the time of European contact, the ahupua'a was the fundamental native land unit extending from mountain to sea, cross-cutting the various concentric island ecozones, and thereby theoretically providing its inhabitants with the essential resources for economic self-sufficiency. The manner in which the ahupua'a economic unit was operationalized has been a topic for discussion, particularly regarding two alternative patterns of residence. One argues for the redistribution of terrestrial and marine resources between permanently resident inland and coastal components of the 'ohana,

or Hawaiian extended family (Handy & Pukui 1972). The other suggests that this redistribution may not have been of goods, but rather of people, with all or a majority of the productive population moving back and forth between the uplands and the coast (Rosendahl 1972). This movement could have followed a predictive long-term seasonal round, or one on a more frequent and opportunistic basis, depending upon the degree of seasonality in the environment and the logistical problems involved. It should also be considered that, in fact, these may not be mutually exclusive strategies, and that both may have functioned in the same territory given local or regional conditions at any point in time.

In retrospect, this last point is important for it significantly complicates the analysis of the local residence pattern, particularly since direct investigation of any possibly associated upland settlements is necessarily beyond the scope of this phase of the research.

Preliminary analysis of the survey and test excavation data from Barbers Point suggested a settlement of functionally integrated, multi-household residence groups (Davis & Griffin 1978; Davis 1980a). Archaeological evidence for these groups was provisionally defined as being the presence of various functionally different but presumably contemporaneous habitation features in close spatial association which collectively reflect a range of activities, domestic and others, defining a residence group composed of several individual households similar to that outlined by Handy and Pukui (1972: 7-11). Identifying such residence groups in the Barbers Point study area further suggested that at least a part of the coastal settlement was likely occupied on a permanent basis.

The new data now provide some confirmation of the overall model, but these same data also raise questions regarding underlying methodological assumptions. This is because (a) in the absence of chronological control it was necessary for the analysis to initially assume the recorded habitation features were contemporaneous, and (b) the analysis depended principally on defining the inferred habitation features according to specific functional criteria. Although various data were utilized to refine these definitions, structural size and form of the survivng architectural features remained the primary discriminators. What was not fully appreciated in this analysis was the potential importance of multi-functional structures in the overall settlement, and the difficulty of distinguishing such features from task-specific features using survey and test data alone and how that may affect the working model.

That task-specific structures do occur in the settlement is supported by the excavation of a well-documented cooking house and an apparently associated feature provisionally inferred to be a sleeping house (Davis ms.). Other functionally specific features in the region include two known ko'a, or fishing shrines, one of which has already been excavated at Barbers Point (Barrera 1975), and the other recently found at West Beach (Barrera 1979).

Finally, a very large, apparently two-tiered platform was found at Ewa Beach (Davis 1980b). The form, size, and apparent expenditure of labor involved in the construction of this platform clearly suggest that this was a rather specialized feature, perhaps functioning in a ritual context.

While such features as these certainly provide the coastal settlement with an air of permanency, it is not known if the occupation itself was on a permanent basis, or if it was only the residential sites which were permanent and which were regularly reoccupied over time.

Indeed, most of the house sites excavated to date have been multi-functional features which often exhibit changes resulting from reoccupation over time, as evidenced by multiple overlapping hearths and associated refuse underlying the existing structures. Several of these sites also exhibit some degree of spatially segregated activity areas. Most of the midden is found associated with the hearths. Those hearths inferred to be contemporaneous with the existing structures are usually found outside the structure itself. This suggests that cooking and eating were not done within the structure, which was probably reserved for such activities as sleeping.

Quantities of volcanic glass were also recovered from the hearth areas of the multi-functional features. The presence and concentration of small cores, flakes, and waste material indicate that glass core reduction was a major activity in these sites, and one which was apparently associated with the hearth area of the sites. However, the association is not complete. No glass was found in the task-specific structures. In the case of the presumed sleeping house, if this inference is correct, the absence of glass material is not especially surprising since no hearth was found in this structure, and secondly it is unlikely that glass knapping would have been an appropriate activity in a sleeping house. On the other hand, the absence of glass in the cooking house is perplexing because the hearths in this feature were large earth ovens for preparing food, and because one of the inferred uses of glass implements is for food preparation (Barrera & Kirch 1973).

Dating the occupation of the different house sites will eventually solve the problem of contemporaneity, but this will help only in part to sort out the ambiguities of function. Any final interpretation of the residence pattern along the southwestern coast of O'ahu must also incorporate the analysis of portable artifacts, the midden, and other kinds of cultural refuse. As this material becomes available, thoroughgoing reconsideration of the basic research design must then continue to direct further research into new areas of theoretical and methodological interest.

SUMMARY

An essential function of the research design is to model what is currently known of a given subject in order to determine new directions for research. As such, it is an analytical device which requires periodic revision as new data become available. This has been the case with the southwestern O'ahu archaeological research over the past three years. A tentative model of human settlement and environmental change developed from the initial survey and test data at Barbers Point was offered as a basis for further investigations. This was subsequently elaborated as new survey data became available, and now preliminary analysis of excavation data provides some confirmation of the overall model. But these same data also raise certain questions regarding underlying methodological assumptions of the present model. These problems have been discussed in the context of redesigning the research strategy proposed for the next phase of archaeological research in southwestern O'ahu.

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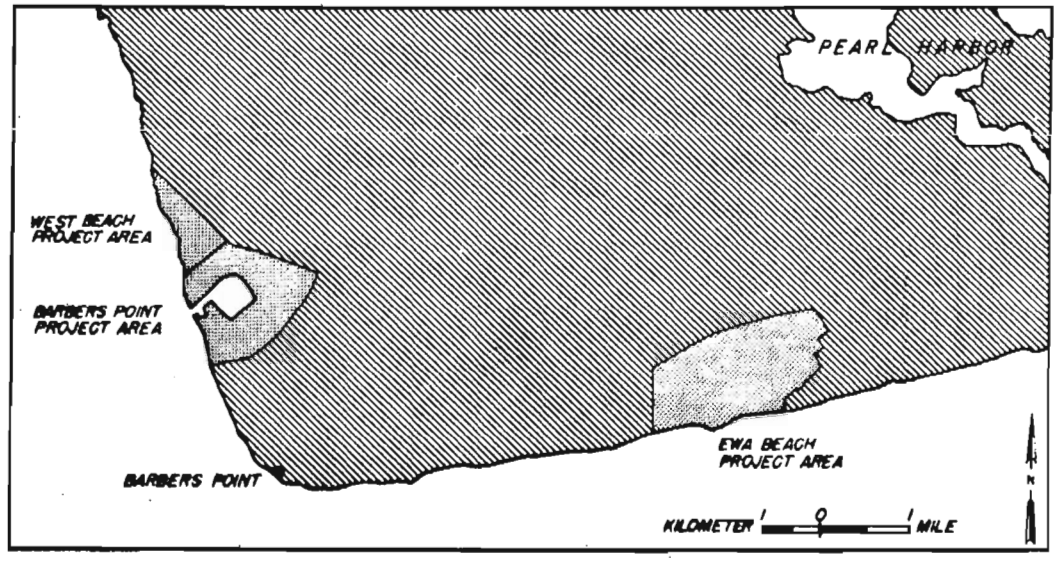

FIGURE 1. Locator map of southwestern O'ahu showing locations of Barbers Point, Ewa Beach, and West Beach study areas.